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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,883	06/26/2003	Steven C. Avanzino	F0361.C1.D1	7845

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EXAMINER

SMOOT, STEPHEN W

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 04/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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**Office Action Summary**

Application No.

10/608,883

Applicant(s)

AVANZINO ET AL.

Examiner

Stephen W. Smoot

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or, extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11, 14, 15, 18, 19 and 21 is/are rejected.
- 7) ☒ Claim(s) 12, 13, 16, 17, 20 and 22 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

This Office action is in response to applicant's RCE filed on 11 April 2005.

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's amendment filed on 11 April 2005 has been entered.

### ***Response to Arguments***

2. Applicant's arguments, see pages 5-6, filed on 11 April 2005, with respect to the rejections of claims 11-18 under 35 USC 102(e) and 35 USC 103(a) have been fully considered and are persuasive. It is agreed that the prior art disclosed by Passemard lacks the as-claimed feature of "the dielectric layer around the opening of the barrier

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dielectric material which separates the non-barrier dielectric from the opening". It is also agreed that the amendments made to the specification and to the claims on 11 April 2005 are supported by the originally filed Fig. 3 and, accordingly, do not introduce new matter. Therefore, the rejections based on the prior art of Passemard have been withdrawn. However, upon further consideration, new grounds of rejection are made in view of Jain as indicated below.

### ***Specification***

3. The disclosure is objected to because of the following informality:

Update the first sentence of the specification (see page 2 of applicant's amendment filed on 09 January 2005) to indicate that 10/226,520 has issued as US 6,642,145 B1.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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5. Claims 11, 14-15, 18-19, 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Jain (US 5,821,168).

Referring to Figs. 1-10 and column 2, line 15 to column 5, line 63, Jain discloses an interconnect structure that includes the following features:

- A semiconductor device substrate (12) with a field effect transistor (40, 42, 44) provided on a top surface;
- An insulating layer (52 in Fig. 3) that includes two oxide films (26, 54);
- A channel opening (72 in Fig. 4) is formed in the upper oxide film (54);
- The exposed surfaces of oxide (26, 54) are converted to silicon oxynitride diffusion barrier portions (56) that separate the oxide films (26, 54) from the channel opening (72) as shown in Fig. 5;
- An adhesion layer (58) that can be titanium (see column 3, lines 59-61) is formed over the silicon oxynitride diffusion barrier portions (56) and lines the channel opening (72) as shown in Fig. 6;
- The channel is filled with electroplated copper (74) that is electrically connected to the source/drain regions (44) corresponding to the field effect transistor as shown in Fig. 10; and
- A copper seed layer (60 in Fig. 7) is used for the electroplating process, which also includes planarization of a composite copper seed/electroplated layer (62 in Fig. 8) by CMP to form a dual inlaid via/channel structure (74) as shown in Fig. 9.

These are all of the limitations set forth in claims 11, 14-15, 18 of the applicant's invention. Regarding claims 19, 21, the adhesion layer (58) can be titanium (see

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column 3, lines 59-61) and the applicant's specification indicates that titanium is inherently capable of functioning as an oxygen getter (see page 7, lines 18-21).

***Allowable Subject Matter***

6. Claims 12-13, 16-17, 20, 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter:

- Claims 12-13, 16-17 would be allowable because the prior art of record does not teach or suggest, in combination with the other claim limitations, an integrated circuit with a dielectric layer that includes a non-barrier dielectric material capable of being changed into a barrier dielectric material and having an opening provided therein, wherein the dielectric layer around the opening is of the barrier dielectric material which separates the non-barrier dielectric material from the opening, and wherein the non-barrier dielectric material is SiCOH; and
- Claims 20, 22 would be allowable because the prior art of record does not teach or suggest, in combination with the other claim limitations, an integrated circuit with a dielectric layer that includes a non-barrier dielectric material capable of being changed into a barrier dielectric material and having an opening provided

therein, wherein the dielectric layer around the opening is of the barrier dielectric material which separates the non-barrier dielectric material from the opening, and further combined with a gettering material of an atomic layer thickness on the barrier dielectric material.

### ***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ahn et al. teach the formation of a barrier layer by nitridation of exposed surfaces of an insulating layer.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00 am to 4:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SWS

Stephen W. Smoot  
Patent Examiner  
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